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ABSTRACT

Personality/behavioral characteristics of empirically derived subgroups of learning disabled (LD) children (8-11 years old) were examined. A modified Halstead-Reitan battery was administered to 56 LD Ss. Their parents completed personality/behavioral measures. Ss' scores on 13 neuropsychological measures were cluster analyzed, and three subgroups were identified. Basically, it appeared that children in subgroup 1 exhibited the most severe and generalized deficits in performance; Ss in subgroup 2 showed a moderate degree of impairment and greater verbal deficits; and Ss in subgroup 3 exhibited the least amount of impairment with slightly greater deficits in visuo/spatial/motor functioning. Data from the Personality Inventory for Children and the Child Behavior Checklist were analyzed, and four dimensions identified. Results were discussed in terms on neuropsychological characteristics. (Author/CL)

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CHILDREN'S LEARNING DISABILITIES IN RELATION TO PERSONALITY AND BEHAVIORAL CHARACTERISTICS

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Objectives

The primary objective of the present study was an attempt to determine the underlying relationships among a set of personality/behavioral measures and a corresponding set of neuropsychological measures of children diagnosed as learning disabled (LD). Furthermore, the associations among these measures and their resulting underlying dimensions were investigated for children with three different neuropsychological profiles.

Perspectives and Theoretical Framework

The present day concept of LD has emerged within about the past 15 years. During that time it has been recognized that the population labeled as LD is quite heterogeneous with respect to numerous variables. Investigators in this field have found it to be productive to narrow the definition of learning disabilities in order to obtain more meaningful information about the characteristics of this population. Rourke (1981) has defined this population as being composed of individuals who "are thought to have marked difficulty in organizing, integrating, and/or synthesizing information as a result of some type of brain dysfunction, and this, in turn, is seen as hampering severely their ability to benefit from 'normal' classroom instruction" (p.453).

Even with this somewhat more restricted view of LD there seems to be

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quite a broad group of children, all classified as LD, who experience diverse learning difficulties as a result of underlying central processing deficiencies. Recently, there have been attempts through neuropsychological assessment batteries to more clearly define subgroups within LD in order to make sense out of this seemingly nebulous heterogeneous population (Petrauskas & Rourke, 1979; Fisk & Rourke, 1979; Lyon & Watson, 1981; Rourke, 1982; Bakker, 1982; Watson, Goldgar & Ryschon, 1983).

In the present study, three subgroups of LD children were empirically derived using these children's neuropsychological assessment data and the statistical technique of cluster analysis. It was found that a subgroup could be differentiated (subgroup 1) that displayed generalized deficits on all measures which were administered. Another subgroup (subgroup 2) could be interpreted as indicating moderate performance relative to the other two subgroups. Subgroup 2 also displayed specific impairment on measures of verbal ability, perhaps related to an underlying dysfunction of the left-hemisphere. A third subgroup (subgroup 3) exhibited the highest level of functioning with slightly lower performance on visual/spatial, visual/constructional tasks.

In the past, studies of characteristics associated with LD have been restricted to the academic or intellectual characteristics of this population, rather than to a consideration of personality or behavioral variables that may be associated with LD. Research in the latter area would appear to be especially salient, since LD children are often referred for assessment because of behavioral problems, as well as academic deficiencies.

From a theoretical standpoint, it would seem reasonable to hypothesize that differences might be found among LD subgroups based on the personality and behavioral characteristics that are often associated with organi-

dysfunction in adults.

A neurological substrate for emotional behavior in man was proposed as early as 1844 by Wigan. He maintained that there was an imbalance between the two hemispheres, such that one side of the brain controlled the other, preventing the behavioral expression by the inferior hemisphere. When this relationship was disturbed, the result was behavioral abnormality or psychopathology - lopsided functioning, so to speak. More recently, researchers have examined different emotional functions related to lateralization in the brain (Heilman & Satz, 1983; Mesuluam, 1981). It was found by Terzian (1964) and by Nebes (1978) that patients who had intracarotid injections of sodium amytal reported feelings of depression if the left-hemisphere was anesthetized and euphoria if the right-hemisphere was deadened. In patients who had unilateral brain lesions, left-hemisphere damage was more likely to produce a depressive-catastrophic reaction, while damage to the right-hemisphere more often resulted in indifference and denial (Gainotti, 1972). D'Elia and Perris (1974) demonstrated that depressed psychiatric patients showed greater left- than right-sided EEG activity. Ross and Rush (1981) also found a relationship between depression and left-hemisphere damage in adult patients. In addition, several other investigators have found anxiety to be a common feature of left-hemisphere involvement (Dilier, 1968; Galin, 1974; Valenstein & Heilman, 1979).

Several investigators in the field of LD have proposed that there may be a personality type associated with LD, and that this may in some way be associated with underlying cortical dysfunction (Rourke, 1982; Fisk & Strang, 1984). In a study by Harklage, Telzrow, DeFillips, Shaw, and Noonan (1983), it was found that preschool children who were low on verbal processing showed a significant tendency toward social isolation. The investigators interpreted

these results as suggesting an underlying functional asymmetry that affected both emotional and cognitive functioning.

The purpose of the present study was to investigate the relationship between previously identified subgroups of LD children and personality/behavioral characteristics.

METHOD

Subjects

Fifty-six children, 13 females and 43 males were included as subjects. The age of subjects included in the study ranged from 8 years 0 months to 11 years 11 months. Subjects were selected from cases referred to the Austin Neurological Clinic for neuropsychological evaluation. All children were first given a vision exam to screen for visual acuity problems. A psychometrician met with the subject's parent(s) in order to obtain a case history, and personality/behavioral data. The children were then administered the children's version of the Halstead Reitan Battery.

Objective criteria for inclusion in the study were as follows: 1. Presenting complaint of academic difficulties (problems with arithmetic and/or language arts); 2. Age between 8 years, 0 months and 11 years, 11 months; 3. Normal corrected or uncorrected vision; 4. Normal hearing; 5. Verbal IQ or Performance IQ of 80 or above on the on the Wechsler Intelligence Scale for Children-Revised (WISC-R, Wechsler, 1974); 6. A primary diagnosis of learning disability as defined by the referring school district (i.e. achievement at least one and a half standard deviations below IQ) without a secondary diagnosis of emotional disturbance or mental retardation.

It should be noted that no objective measures were used to exclude children with environmental, cultural, or economic disadvantage from the

sample. The rationale for this decision is based on the finding by Rutter, Tizard, & Whitmore (1970) that there were not significant differences between the specific reading retardation of children with social disadvantage and those without. However, it should also be noted that an attempt was made clinically to identify and exclude those children whose learning problems seemed to stem from social/emotional adjustment or behavior problems.

The mean age of the subjects included in the sample was 9 years 7 months with a standard deviation of 13.29 months. The mean and standard deviation of the subjects' WISC-R Verbal IQ, Performance IQ and Full Scale IQ was as follows: VIQ, $\bar{X}$=100.74 σ=13.24; PIQ, $\bar{X}$=101.18 σ=17.11; FIQ, $\bar{X}$=100.91 σ=14.48

Measures

The subjects were administered the children's version of the Halstead Reitan Battery in one or two test sessions. Thirteen measures from this battery were chosen to be included in the cluster analysis based on past research and the statistical requirements of the cluster analysis technique (see table 1). For example, certain WISC-R subtests were chosen because of their demonstrated sensitivity to organic dysfunction in previous research studies (Gaddes, 1980).

What follows is a brief description of the measures included in this study, and the primary functions which they have been reported to measure:

Wechsler Intelligence Scale for Children - Revised Subtests (Wechsler, 1974)

Verbal IQ (VIQ): VIQ is a general measure of verbal ability. It is a composite subtest which includes the Information, Comprehension, Arithmetic, Similarities, Digit Span, and Vocabulary subtests of the WISC-R. VIQ is considered to be a broad measure of left-hemisphere functioning.

Performance IQ (PIQ): PIQ is a general measure of visual/spatial, nonverbal ability. It is also a composite subtest which includes the Coding, Picture

Completion, Block Design, Picture Arrangement and Object Assembly subtests of the WISC-R. PIQ is considered to be a broad measure of right-hemisphere functioning.

Vocablulary: Vocabulary is a relatively sensitive measure to lesions in the left hemisphere.

Similarities: Similarities is considered to be one of the best predictors from the WISC-R of left-hemisphere functioning.

Picture Arrangement: Picture Arrangement scores are more depressed by right-hemisphere lesions than left-hemisphere lesions.

Block Design: This test is considered to be sensitive to posterior right-hemisphere functioning.

Coding: This test is thought to be one of the most sensitive WISC-R subtests to brain damage regardless of the locus of the dysfunction.

Reitan Aphasia Screening Battery (Halstead & Wepman, 1959)

Total Aphasia: This is a general measure of communication problems and aphasic disabilities. It is composite of items related to naming, copying, writing, simple arithmetic, and expressive language functioning. The total aphasia score is considered to be a general measure of higher cerebral functioning, somewhat more sensitive to left-hemisphere than right-hemisphere functioning.

Constructional Dyspraxia: This is a measure of visuo/spatial, visuo/constructional ability. The subject must copy a set of figures from pictures which s/he is presented. This measure is considered to be more sensitive to right-hemisphere than left-hemisphere functioning.

Wide Range Achievement Test (WRAT) (Jastak & Jastak, 1965)

WRAT-Reading: This test is an academic measure of reading ability. It is thought to be somewhat more sensitive to left- versus right-hemisphere

functioning.

WRAT-Spelling: This is an academic measure of spelling ability. It is also considered to be slightly more sensitive to left- versus right-hemisphere functioning.

WRAT-Arithmetic: This is an academic measure of a broad range of mathematical ability. This test is considered to be somewhat more sensitive to right-hemisphere than left hemisphere functioning.

Halstead-Reitan battery (Reitan & Davison, 1974)

Tactile Finger Recognition: This is a test of spatial localization. The examiner assigns a number to each finger. When the subject's eyes are closed the examiner touches the subject's fingers, and the subject must report the number of the finger which has been touched. This test is generally considered to be sensitive to right-hemisphere functioning.

Much of the description of the above measures has been taken from Lezak's (1983) discussion of neuropsychological assessment.

Personality Inventory for Children (Wirt, Lachar, Klinedinst, & Seat, 1977)

This is an empirically and rationally constructed instrument that seeks to provide personality descriptions of children in the range of 6-16 years of age. It is composed of 600 true-false questions, and is completed by the child's parents.

This measure includes 33 scales, of which 16 are profile scales. Score elevations in a positive direction on the clinical scales increase the likelihood of significant pathology.

Child Behavior Checklist (Achenbach & Edelbrock, 1983)

This instrument has also been empirically and rationally constructed. It is designed to provide information on the behavioral problems and competencies of children between the age of 4 through 16. It is composed of 118 items, and is

completed by the child's parents.

This measures includes 11 profile scales, 6 of which are common to both the male and female forms of the test. Score elevations in a positive direction on the 11 profile scales indicate an increased likelihood of significant pathology.

Modifications of Test Scoring

It should be noted that certain test scores were recoded to obtain a common direction of meaning of the scores relative to the traits being studied. The measures that this procedure was applied to were two measures from the Aphasia Screening Test (Halstead & Wepman, 1959) - the Total Aphasia score and the Constructional Dyspraxia score, and also the Tactil Finger Recognition measure from the Halstead Reitan (Reitan & Davison, 1974). This procedure was followed, so that all measures would be scored in the same direction.

Finally, the subjects' WRAT spelling errors were coded for phonetic correctness using Boder's (1982) guidelines for the phonetic classification of misspellings. This coding was carried out by two educators, who had extensive spelling and reading remediation experience. The interrater reliability estimate obtained from their codings was .81 indicating close agreement. Each subject was given a score based on the percentage of phonetically correct errors out of the total number of spelling errors that s/he made (phonetic errors/total errors = percentage of phonetically correct misspellings). This classification was carried out in order to provide external validation of the empirical classification of the data.

RESULTS

The data obtained from the subjects were first analyzed using the statistical method of cluster analysis. The heirarchical clustering procedure employed was Ward's method from SAS package (Ray, 1982), which utilizes distances based on the sum of squares between clusters, added up over all the variables.

A second analysis was carried out using the subjects' data from the spelling subtest of the WRAT. Misspellings from the WRAT were coded for phonetic correctness (See Methods section). It was found through the multivariate analysis of variance that the three groups differed significantly on the percentage of phonetic misspellings that they made on the WRAT. Group 3 had the largest percentage of phonetically correct spelling errors, group 2 had the next largest percentage on this measure, and group 1 had the smallest percentage of phonetically correct misspellings (See Table 2).

Next, the technique of Multidimensional Scaling (MDS) was employed to determine the underlying dimensions of the personality/behavioral variables from the three subgroups. MDS is a technique which is similar conceptually to Factor Analysis. MDS was used in the current investigation to simplify the data in order to improve the interpretability of the results obtained from the three subgroups on the PIC and CBC. The INDSCAL option with the ALSCAL program available on SAS was used to analyze the data. The INDSCAL program for MDS was employed because past research has found that INDSCAL typically discovers dimensions which are valid and interpretable from a psychological framework (Kruskal, 1978; Schiffman, Reynolds & Young, 1981).

First, an intercorrelation matrix of the 19 scales of the PIC and CBC was obtained for each of the three LD subgroups (See Table 3 for the scales used).

It was decided to eliminate the Hyperactivity scale of the PIC, because of its high negative correlation with many of the other PIC and CBC scales. The high negative correlations associated with this measure would have caused a distortion in the results obtained from the MDS analysis.

Next, the three correlation matrices obtained from the LD subgroups were entered into the MDS analysis. The MDS analysis achieved a satisfactory solution with a four-dimensional configuration that accounted for 83% of the variance. A subjective analysis of these dimensions indicated that dimension one simply differentiated the subscales of the two measures used. Dimension two seemed to be related to the direction of the behavior problem, with one end of this dimension being problems with the external world and the other end being problems with self. For example, negative coordinates were assigned to the Somatic Complaints, Depressed and Internalizing CBC scales indicating they were at the high negative end of dimension two, while the Delinquent, Aggressive and Externalizing scales of the CBC were assigned positive coordinates indicating their placement at the high positive end of this dimension (see Table 3 & 4).

Dimension three appeared to be related to the <u>type</u> of social interaction problems. It can be seen by examining the scale coordinates on this dimension that Social Skills (PIC), Social Withdrawal (CBC) and Psychosis (PIC) are at the negative end of this dimension, and the Somatic Complaints, Aggressive and Delinquent scales of the CBC are at the positive end of this dimension (see Table 3 & 4). The negative end of dimension three may be related to problems in social interaction associated with poor social skills and withdrawn behavior, while the positive end of this dimension may be related to social interaction problems associated with attention seeking, acting out behavior.

Finally, dimension four seemed to be related to either intra or interpersonal problems, with the negative end of this dimension being related to problems in self-absorption, and the positive end of the dimension being related to problems in interpersonal relationships. At the negative end of dimension four are the PIC scales Somaticizing, Withdrawal and Development, and at the positive end are the scales Family Relations, Social Skills and Delinquency of the PIC (see Table 3 & 4).

It should be noted that the labels attached to these dimensions are arbitrary in nature, and are simply used in an attempt to facilitate communication.

In addition, the MDS analysis provided information concerning the importance of each of the dimensions to each subgroup. It can be seen from the subject weights in Table 5 that in terms of the three personality/behavioral dimensions, dimension two was the most salient to subgroup 2, dimension three was the most important to subgroup 3, and dimension four was the most salient to subgroup 1.

DISCUSSION

The results from the analysis of these three subgroups' neuropsychological data, and personality/behavioral data suggest 5 major interpretive areas:

1. Neuropsychological Subgroups : The findings from the cluster analysis indicate that 8 to 11 year old LD children can be classified empirically into distinct subgroups. It appeared that the major feature that differentiated these three groups was level of performance, subgroup 1 showed the lowest level of performance across all neuropsychological measures, subgroup 2 exhibited a moderate level of performance in relation to the other two subgroups, and subgroup 3 showed the highest level of performance on all measures (see Table 1). Similar results, in terms of subgroups exhibiting relatively high or low levels of performance, have been reported by other investigators in this field. Petrauskas & Rourke (1979) reported an LD subgroup with a minimal VIQ/PIQ discrepancy and uniformly poor WRAT scores, and Satz & Morris (1981) reported an undifferentiated low functioning LD subgroup, likewise Watson et al. (1983) and Lyon, Stewart & Freedman (1982) found "normal" or "minimal deficits" groups in their samples of LD children. The differences on level of performance on neuropsychological measures may be interpreted as indicating different levels of diffuse versus specific organic dysfunction. For example, the Coding subtest of the WISC-R has been related to generalized cortical dysfunction in past research (Rourke, Bakker, Fisk, & Strang, 1983). All three subgroups scored the lowest on this subtest in relation to the other subtests of the WISC-R which were analyzed, and again there was a level effect, such that subgroup 1 had the lowest Coding score, subgroup 2 had the middle Coding score, and subgroup 3 had the highest score on Coding.

The second aspect suggested by the neuropsycholgical data, which separated the LD subgroups found in this study, may be related to specific versus diffuse organic dysfunction. Subgroup 2 showed the most distinctive pattern of performance with lower verbal abilities in a context of visuo/spatial/constructional strengths. In general, the pattern of performance exhibited by subgroup 2 has been attributed by a number of investigators to a relative weakness in left-hemisphere functioning (Bakker, 1982; Rourke, 1982; Lyon et al., 1982). Subgroup 3 showed some indication of relative weakness in right-hemisphere functioning with slightly poorer performance on visuo/spatial/constructional tasks and very good performance on verbal/linguistic tasks, but this pattern was less pronounced than the pattern exhibited by subgroup 2. (See Table 1 for the means and standard deviations of subgroup 1, 2 & 3 on the cluster variables.)

2. External Validation of Neuropsychological Subgrouping : The significant results found on the Achievement (ACH), Intellectual Screening (IS) and Development (DVL) subscales of the PIC tended to confirm the subgroups obtained in the cluster analysis of the neuropsychology data. For example, subgroup 1 exhibited the lowest functioning on all neuropsychological measures in the cluster analysis, and this group had the highest amount of parental concern on the ACH, IS and DVL subscales of the PIC. Subgroup 2 had moderate scores on neuropsychological measures, and they showed moderate scores on ACH, IS and DVL. Finally, subgroup 3 showed the highest level of performance on the neuropsychological measures, and the least degree of parental concern on ACH, IS and DVL relative to the other two subgroups (See Table 1 & 2).

Similarly, the findings from the phonetic coding of subjects' misspellings on the WRAT-Spelling helped to confirm the subgroups obtained by

the cluster analysis. A significant difference was found among the three subgroups on the percentage of phonetically correct spelling errors obtained, with subgroup 3 having the best phonetic spelling, subgroup 2 having the next best, and subgroup 1 having the worst phonetic spelling.

(The analysis of the WRAT-Spelling and the PIC scales through the multivariate analysis of variance was carried out as a secondary procedure to the cluster analysis of the neuropsychological data.)

3. Personality/Behavioral Dimensions : Results from the multidimensional scaling of the PIC and CBC data indicated that there were four dimensions underlying the personality/behavioral measures used in this study. The first dimension appeared to be separating the two tests, which is not surprising, since the PIC and CBC were independently constructed instruments. Dimension two seemed to be related to the direction of the pathology, in terms of self, with one end of this dimension being problems with the self and the other end being problems with the external world. The third dimension appeared to be related to the type of social interaction problems, with one end of this dimension being problems with social withdrawal and the other end being problems with attention seeking, acting out behavior. Dimension four seemed to be related to problems with either intrapersonal difficulties or problems in interpersonal relationships. (See Table 3 & 4 for scales and coordinates relevant to dimensions 2 through 4)

4. Personality/Behavioral Characteristics of the Entire LD Sample : There appeared to be a distinctive personality and behavioral pattern which can be discerned when the PIC and CBC data were analyzed using the four dimensional solution. The results will be discussed in terms of dimensions two through four, since these were the dimensions related to personality and behavioral functioning. As a single group these children showed a pattern of

scores that indicated slightly greater rates of internalizing versus externalizing problems; difficulties with social interaction associated with poor social skills and social withdrawal; and, a mixture of intra and interpersonal problems. In comparison to the norm group of the CBC, the children in this sample scored above the 90th% on the Depressed, Social Withdrawal, Hyperactive, Internalizing and Externalizing scales. And in comparison to the PIC norm group, this sample of LD children scored above the 90th% on the Adjustment, Depression, Delinquency and Psychosis scales.

On the scales relevant to dimension two, this sample of LD children appeared to exhibit somewhat more elevated scores on the scales that were at the internalizing end of this dimension. In particular, on the CBC scales, parents reported greater problems in their LD children with Depression, Social Withdrawal, and Internalizing than Delinquency or Aggression.

The scales which are relevant to dimension three seemed to indicate that these children have greater problems at the end of dimension three associated with poor social skills and social withdrawal. They had relatively low scores on the Somatic Complaints scale of the PIC and the Aggressive and Delinquent scales of the CBC, but they had relatively elevated scores on the Social Skills and Adjustment scales of the PIC, as well as high scores on the Social Withdrawal scale of the CBC. These findings indicate that this sample of children has greater problems with social withdrawal or isolation than attention seeking, acting out behavior.

On the scales relevant to the two ends of dimension four these children had scores which were somewhat difficult to interpret. For example, on the positive end of dimension four they showed relatively elevated scores on the Delinquency (PIC) and Social Skills (PIC) scales, but lower scores on Family Relations (PIC). Similarly, on the negative end of dimension four these

children exhibited elevated scores on the Hyperactive (CBC) scale, but lower scores on the Withdrawal and Somaticizing scales of the PIC. This mix of high and low scores at both ends of dimension four made it difficult to determine whether these children were experiencing more difficulty in the intra or interpersonal sphere. The elevated scores on the scales Hyperactive (CBC) and Development (PIC) at one end of this dimension, in conjunction with relatively high scores on Social Skills (PIC) and Delinquency (PIC) at the other end of this dimension may indicate some problems in both the intra and interpersonal realms. (See Figures 1 and 2 for an overall representation of the subgroups' profiles)

5. Personality/Behavioral Characteristics of Subgroup 2 : In terms of the differences among the three subgroups as revealed by the subject weights from the INDSCAL analyses, dimension two (internalizing/externalizing) was more salient to subgroup 2 than the other two subgroups. In other words, when the parents of subgroup 2 were completing the PIC and CBC, the underlying dimension which influenced their responses was their concern with the internalizing/externalizing dimension of their children's behavior. In examining subgroups 2's scores on the scales relevant to dimension two, it can be seen that their scores are more elevated at the internalizing end of this dimension. Subgroup 2 also exhibited the most distinctive pattern of performance on the neuropsychological measures used for subgrouping, with lower verbal abilities in the context of strengths in visual/spatial functioning.

Summary

The particular behavioral and personality pattern exhibited by these three groups of LD children appear to indicate that these children are experiencing problems in relation to self, such as depression. They also

exhibit a pattern of difficulties in social interaction, and some problems with both intra and interpersonal relationships.

Second, it is interesting to note that the three subgroups exhibited somewhat similar profiles on the PIC and CBC. The similarity of the three subgroups on the personality and behavioral variables may indicate that there may be a general effect of LD on behavior, regardless of the degree and type of learning disorder.

Probably the most interesting finding, from a neuropsychological perspective, is that subgroup 2 had the highest scores on a number of PIC and CBC scales. For example, on the CBC they scored significantly higher on the Depression and Internalizing scales than the other two subgroups. They scored highest, though not significantly, on the Depression and Anxiety scales of the PIC. In addition, the internalizing/externalizing dimension was the most salient to subgroup 2, and they had elevated scores in the internalizing direction of this dimension. In regard to neuropsychological functioning, subgroup 2 exhibited a moderate overall performance in relation to the other two subgroups, but they showed the most distinctive pattern of performance, with lower verbal functioning than visuo/constructive, visuo/spatial functioning. Taken together, these findings may indicate that the possible left-hemisphere basis to their LD may be serving to accentuate their personality and behavioral characteristics. This conclusion is drawn from the evidence that adults with left-hemisphere dysfunction often experience depression and anxiety (Valenstein & Heilman, 1979; Ross & Rush, 1981; Nebes, 1978). This conclusion is also supported by the findings that preschool children with low verbal processing abilities show a tendency toward social isolation (Hartlage et al., 1983).

The purpose of the present study was to extend our understanding of the

personality and behavioral characteristics associated with subgroups of LD children. Unfortunately, one limitation of the present study is that parental report measures were the only personality/behavioral measures used. In future research with LD subgroups, it would be extremely useful to obtain some direct measure of behavioral functioning.

Finally, there appear to be some preliminary recommendations for intervention that can be made based on the findings of the current study. It would seem to be important to attempt to improve the social skills of these children, and their impulse control. This would possibly improve their peer relationships, which may lead to an increased sense of self-worth and a reduction in internalizing problems, such as depression. In addition, it would be important to identify those children who show a profile of left-hemisphere dysfunction similar to the profile exhibited by subgroup 2. These children would seem to be especially at risk for personality/behavioral problems.

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Table 1
Neuropsychological Test Results for LD Subgroups

Cluster Variables	Means & Standard Deviations of Clustering Groups					
	Group 1 n=15		Group 2 n=28		Group 3 n=13	
	$\bar{X}$	σ	$\bar{X}$	σ	$\bar{X}$	σ
[a] Verbal IQ	99.56	10.57	96.26	10.09	116.41	5.10
[a] Performance IQ	87.56	10.30	101.66	12.00	113.88	15.12
[a] Vocabulary	8.00	2.37	8.97	2.94	13.24	1.56
[a] Similarities	9.52	2.43	10.03	2.61	15.00	1.73
[a] Picture Arrangement	8.83	2.21	11.37	2.51	13.23	2.82
[a] Block Design	7.74	3.15	9.94	2.79	12.00	2.69
[a] Coding	5.70	2.20	8.40	2.65	9.06	2.46
[b] WRAT-Reading	3.79	1.42	4.61	1.33	6.09	1.62
[b] WRAT-Spelling	3.24	1.25	3.97	1.04	5.03	1.38
[b] WRAT-Arithmetic	3.06	.61	3.59	.84	3.91	.62
[c] Total Aphasia	4.74	2.73	8.11	2.51	9.53	2.79
[d] Constructional Dyspraxia	.09	.29	1.23	.94	.82	.95
[e] Tactile Finger Recognition	9.13	4.36	10.51	3.82	11.47	2.43

Note: All tests are scored in a positive direction, such that a high score reflects less dysfunction.

a. Wechsler Intelligence Scale for Children - Revised Subtest (1974)
b. Wide Range Achievement Test (1978)
c. Aphasia Screening Battery scored according to the system of normative standards developed by Selz & Reitan (1979) for 9 to 14 year old children
d. Aphasia Screening Battery Items 1,4,7,29 scored according to the system of normative standards developed by Selz & Reitan (1979) for 9 to 14 year old children
e. Halstead Reitan (Reitan & Davison, 1974)

Table 2

Behavioral Data for LD Subgroups

Personality/Behavioral Variables	Means & Standard Deviations of Subgroups						Significance Level
	Group 1		Group 2		Group 3		
	$\bar{X}$	σ	$\bar{X}$	σ	$\bar{X}$	σ	
[a] Lie	44.50	9.23	44.46	11.37	42.18	6.43	p<.79
[a] F	63.30	18.31	62.88	20.45	48.73	6.74	p<.07
[a] Defensiveness	48.60	13.71	42.00	15.46	46.64	7.09	p<.30
[a] Adjustment	76.00	16.79	78.08	15.78	69.54	12.24	p<.31
[a] Achievement	72.53	14.61	65.46	11.50	54.82	9.32	p<.01
[a] Intellectual	79.87	18.53	65.54	23.77	43.36	15.84	p<.01
[a] Development	74.80	11.65	62.77	11.69	55.09	8.10	p<.01
[a] Somatic Concern	58.47	13.35	58.31	12.93	51.64	10.99	p<.30
[a] Depression	62.07	16.19	66.42	15.45	57.82	12.34	p<.27
[a] Family Relations	55.00	12.52	58.61	12.64	53.82	9.56	p<.46
[a] Delinquency	65.07	15.30	64.54	13.25	61.45	9.38	p<.76
[a] Withdrawal	56.47	16.15	53.77	11.44	51.82	9.45	p<.64
[a] Anxiety	58.93	16.93	66.88	17.49	56.45	10.45	p<.13
[a] Psychosis	68.80	20.25	63.65	13.61	57.00	12.27	p<.17
[a] Hyperactivity	55.07	11.40	55.92	18.85	61.09	12.62	p<.59
[a] Social Skills	65.53	12.33	60.88	12.69	59.91	14.03	p<.45
[b] Depressed	56.40	16.16	71.54	14.20	61.92	14.81	p<.01
[b] Somatic Complaints	55.27	10.53	62.21	22.36	55.31	13.09	p<.36
[b] Social Withdrawal	63.13	16.24	67.64	17.86	65.15	13.29	p<.68
[b] Hyperactive	69.33	14.33	76.00	13.75	70.92	9.13	p<.23
[b] Aggressive	59.13	13.02	64.32	15.53	59.92	10.62	p<.43
[b] Delinquent	61.67	17.60	62.79	19.70	60.15	14.59	p<.91
[b] Internalizing	60.20	17.32	75.43	17.69	62.46	14.11	p<.01
[b] Externalizing	64.00	14.06	70.21	14.76	64.77	10.33	p<.28
[c] Phonetics/WRATS	55%	29%	62%	24%	76%	17%	p<.05

a. Personality Inventory for Children (Wirt, Lachar, Klinedinst & Seat, 1977)

b. Child Behavior Checklist for ages 6 to 11 (Achenbach & Edelbrock, 1983)

c. WRAT spelling errors coded according to Boder's scheme for the phonetic classification of misspellings (Boder & Jarrico, 1982).

Table 3
Four Dimensional Solution
Scale Coordinates

Behavioral/Personality Scales	Dimensions			
Child Behavior Checklist	1	2	3	4
Depressed	-1.18	-1.30	.42	.70
Somatic Complaints	.05	-2.38	1.75	-.14
Social Withdrawal	-1.14	-1.47	-1.04	.27
Hyperactive	-1.71	.25	-.73	-1.11
Aggressive	-1.11	1.32	1.64	.08
Delinquent	-1.09	1.33	1.50	.60
Internalizing	-.89	-1.40	.72	.12
Externalizing	-1.28	1.13	1.13	.13
Personality Inventory for Children				
Adjustment	.62	.67	-.99	-.44
Development	.98	.87	-.38	-1.15
Somatic Concern	1.13	-.03	.42	-1.74
Depression	.91	-.02	-.48	-.14
Family Relations	.94	.23	.49	2.36
Delinquency	1.04	.49	-.33	1.30
Withdrawal	1.07	-.15	-.83	-1.35
Anxiety	.72	-.03	-.83	.38
Psychosis	.58	.13	-.98	-.91
Social Skills	.35	.38	-1.48	1.06

Table 4
PIC and CBC scales relevant
to Dimensions 2 through 4

	Dimension 2 Internalizing/ Externalizing	Dimension 3 Attention Seeking/ Social Withdrawal	Dimension 4 Interpersonal/ Intrapersonal
High Positive	Delinquent (CBC) Aggressive (CBC) Externalizing (CBC) Development (PIC)	Somatic Complaints (CBC) Aggressive (CBC) Delinquent (CBC) Externalizing (CBC)	Family Relations (PIC) Delinquency (PIC) Social Skills(PIC)
Moderate	Social Skills (PIC) Hyperactive (CBC) Psychosis (PIC) Depression (PIC) Withdrawal (PIC)	Family Relations (PIC) Depressed (CBC) Somatic Concern (PIC) Delinquency (PIC) Depression (PIC)	Delinquent (CBC) Social Withdrawal (CBC) Anxiety (PIC) Somatic Complaints (CBC) Depression (PIC)
High Negative	Depressed (CBC) Internalizing (CBC) Social Withdrawal (CBC) Somatic Complaints (CBC)	Withdrawal (PIC) Psychosis (PIC) Adjustment (PIC) Social Withdrawal (CBC) Social Skills (PIC)	Psychosis (PIC) Hyperactive (CBC) Development (PIC) Withdrawal (PIC) Somatic Concern (PIC)

Note: See Table 3 for the dimension coordinates.

Table 5
Four Dimensional Solution
Subject Weights

Subjects (Subgroups)	Dimensions 1	2	3	4
1	.54	.14	.28	.53
2	.69	.59	.32	.03
3	.75	.42	.38	.09

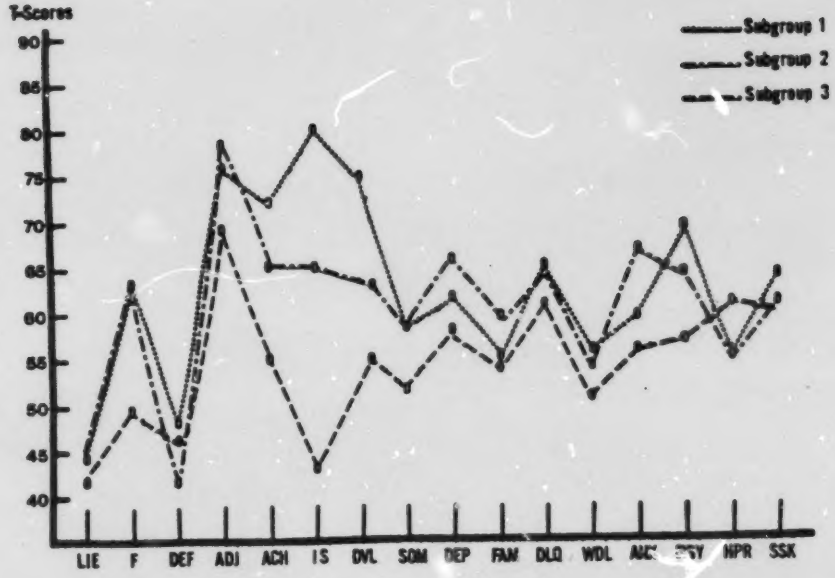

Figure 1. Personality Inventory for Children - Scales (Wirt, Lachar, Klinedinst & Seat, 1977)
Lie (LIE), F (F), Defensiveness (DEF), Adjustment (ADJ), Achievement (ACH), Intellectual Screening (IS), Development (DVL), Somatic Concern (SOM), Depression (DEP), Family Relations (FAM), Delinquency (DLQ), Withdrawal (WDL), Anxiety (ANX), Psychosis (PSY), Hyperactivity (HPR), Social Skills (SSK)

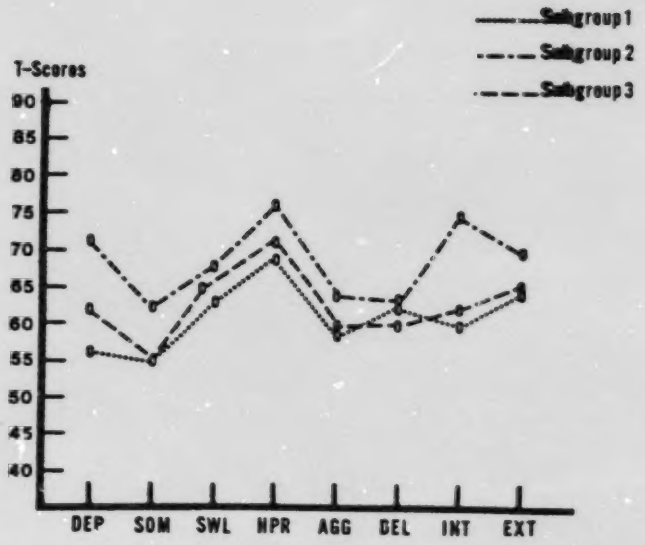

Figure 2. Child Behavior Checklist - Scales (Achenbach & Edelbrock, 1983) Depressed (DEP), Somatic Complaints (SOM), Social Withdrawal (SWL), Hyperactive (HPR), Aggressive (AGG), Delinquent (DEL), Internalizing (INT), Externalizing (EXT)

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Abstract

Personality/Behavioral characteristics of empirically derived subgroups of learning disabled children were examined. A modified Halstead-Reitan battery was administered to 56 LD children, and their parents filled out personality/behavioral measures on these children. The subject's scores on 13 neuropsychological measures from the Halstead-Reitan battery were cluster analyzed, and tnree subgroups were identified. Basically, it appeared that children in subgroup 1 exhibited the most severe and the most generalized deficits in performance; children in subgroup 2 showed a moderate degree of impairment and greater verbal deficits; and children in subgroup 3 exhibited the least amount of impairment with slightly greater deficits in visuo/spatial/motor functioning. Next, data from the Personality Inventory for Children and the Child Behavior Checklist was analyzed using Multidimensional Scaling, and four dimensions were identified. The children's results on these personality/behavioral dimensions were discussed in terms of their neuropsychological characteristics.